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Introduction to microcomputer processing capabilities; Management advisory services special report

American Institute of Certified Public Accountants

A Management
Advisory Services
Special Report

Introduction to Microcomputer Processing Capabilities

A special report developed for CPAs seeking to become familiar with the capabilities and limitations of this important tool, useful in client engagements and internal operations.

AICPA American Institute of Certified Public Accountants

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Preface

Microcomputers are becoming an ever more important tool for the CPA. They are enhancing a practitioner's ability to provide audit, tax, and management advisory services (MAS) and to manage the practice. Practitioners need to know microcomputers' strengths and limitations as well as the general capabilities of applications program packages that are of potential value in serving clients and managing the practice. Therefore, the MAS Division of the AICPA has prepared this special report to inform practitioners about the current status of microcomputer processing capabilities. It is intended to be most helpful to those practitioners who have not yet attained the familiarity with microcomputers that is appropriate for a CPA practice today.

No attempt has been made to make this document a state-of-the-art report because both technology and applications are changing rapidly. Waiting for the changes to slow or for microcomputer technology to stabilize may be futile for a number of years to come. Practitioners who wait to acquire microcomputers may find that they have merely delayed taking advantage of the benefits. However, the practitioner is cautioned to proceed with care and to confer with others more experienced in the selection and use of microcomputer hardware (equipment) and software (computer programs). Limitations do exist, and there is wide variation in the quality, reliability, and compatibility of the various software and hardware components.

Contents

Key Microcomputer and Software Functions

The heart of the microcomputer revolution has been the proliferation, capabilities, and user-friendliness* of software packages. Over the past few years, literally thousands of different packages have been introduced, some of a general-purpose nature and others targeted to specific applications. Since these packages are usually priced inexpensively in contrast to the cost of an individual development effort, almost every microcomputer user acquires some software products. It is important to recognize the characteristics and limitations of software packages, which make it possible for the microcomputer to perform the following key functions.

Electronic Spreadsheets

Electronic spreadsheet packages have become so popular that they are probably responsible for the sale of more microcomputer systems than any other single product to date. Numerous packages have emerged over the years, all of which have the same basic processing capabilities, which include (1) inputting data in rows and columns; (2) performing arithmetic calculations with this data; and (3) defining relationships between data. The packages provide the user with visual display of the desired array of data on the screen and the ability to produce some form of hard-copy printout. Based on the generalized utility of these products, many vendors have evolved and are marketing templates. Templates consist of all the logic necessary for a specific application, with the user required to provide only the data necessary for the array.

Vendors have added numerous enhancements to these packages; however, the impact of those additions may be a reduction of memory space available for the spreadsheet itself (which typically resides completely in computer memory). To offset this problem, vendors have developed software with overlay structures so that not all the software needs to be resident in memory at any given point in time. In the case of larger spreadsheets, the latter alternative may cause some slowdown in processing.

*A glossary of computer terms appears at the end of this report.

Some functional capabilities that have been developed for electronic spreadsheets include (1) larger arrays of data; (2) linking together multiple templates, thus providing the means to develop more complex applications; (3) processing three-dimensional arrays; and (4) significant improvements in report-formatting capabilities.

Electronic spreadsheet packages are not turnkey systems. The user cannot simply install the package and be running an application immediately; he must still incorporate his logic (sequence of steps to be executed) into the array and define the data that he will process. Inasmuch as the user still needs to specify the logic, these packages are perceived by some as merely high-level programming languages.

Data Base Management Systems

Data Base Management Systems (DBMS) software packages provide the user with an easy means of defining the structure of a collection of data, designing video screen formats for inputting the data, maintaining the data, and producing reports from the data files. In many straightforward applications, DBMS software may suffice for the total application development effort. However, more complex situations may require interfacing DBMS-maintained files with other packages or programs custom written by the user. The ease of accomplishing such an interface will depend on the package chosen.

DBMS packages currently on the market vary significantly in many areas, for example, maximum size of fields, number of fields per record, maximum size of record, maximum number of records in the data base, number of key fields supported, ability to sort data, number of screen formats and report formats available, report-formatting capabilities, calculation capabilities, number of totals to be accumulated, and so on. The significance of any package's limitations will depend on the expected utilization of the software in a particular environment.

Word Processing

Word processing has become such a major area in itself that many special-purpose computers whose sole function is word processing have emerged. However, basic microcomputer capabilities include this function, and word processing packages are available for almost every microcomputer. The basic capabilities of word processing packages include inputting text, editing and manipulating text, and producing formatted hard-copy printouts. For correspondence it is desirable to have a letter-quality printer to support word processing requirements rather than the faster but lower image-quality dot-matrix printer.

Many word processing packages provide numerous enhancements designed primarily to facilitate text input and editing. Multiuser microcomputer systems will normally allow concurrent input of documents by different users, with the disk serving as a collection and storage device for such documents. Other packages provide for a direct interface between the word processing software and the associated DBMS package by allowing the user to merge name-and-address information into form letters or invoices.

The user-friendliness of a word processing package is a major concern since non-data processing personnel will generally be using it.

Mailing Lists

Mailing list software packages are available as stand-alone products or as add-on options for word processing or DBMS systems. In general, mailing list software maintains lists of names and addresses by using a code for each entry. Users can then selectively retrieve names and addresses for a particular mailing list, and they normally receive as output a list of recipients and the mailing labels for that particular selection.

In some cases word processing software that interfaces with a DBMS package may satisfy mailing list requirements. However, if a user needs only mailing list capabilities, a stand-alone package might be more cost-effective than acquiring the more expensive word processing and DBMS systems.

Financial Analysis

Many software packages for financial analysis are available. These products tend to be fairly specialized and may be of significant value in solving a particular problem. Inasmuch as they are not intended to be general-purpose in nature, as some of the aforementioned packages are, their use should be fairly straightforward, as documented by the vendor.

Users may be dealing with areas of financial analysis having regulatory aspects that might be subject to change. In such situations the ability to modify the software and the vendor's committment to support the product may be significant.

Accounting Packages

There are numerous packages that address accounts receivable, accounts payable, payroll, inventory, general ledger, and client write-up systems. Some vendors provide some or all of these packages as independent options; others integrate all the products. The choice of the particular package will, of course, depend on the user's requirements. However, these packages typically lack

flexibility for user modifications in such areas as size of account number, size of employee number, size of part number, chart of accounts, and number of general ledger accounts. It is therefore essential to determine beforehand that the selected package will satisfy the accounting and processing requirements of the user and that the user's volume will present no problem to the software package or the microcomputer's storage capacity.

Tax-related Packages

Many products that assist in tax planning, tax preparation, and estate planning have become available. Users should be concerned about the completeness of such products, particularly with regard to state and local tax regulations. Because these applications are subject to frequent changes, users should carefully evaluate the vendor's reputation, experience, and commitment to provide updated versions on a timely basis.

Development Tools

Despite the availability of many software packages that help make the microcomputer productive quickly, there are still numerous areas that either have not been addressed by software packages or are highly specialized for particular users. In order to fill this gap, users will want to develop their own software or supplement packages that have already been purchased. Numerous tools are available to customize software.

Programming Languages

The most common microcomputer programming language is BASIC. BASIC is comparatively easy to learn. Other common languages include COBOL, FORTRAN, and PASCAL. A user's choice of languages depends on many factors, including what is available on the specific microcomputer, the nature of the problem to be solved by custom programming, and the relative skills of the personnel involved. It is important for the user to recognize that any software requiring custom development through the use of a programming language will also require significantly more time for implementation.

Program Generators

A new class of generalized software products known as program generators provides a more user-friendly and expedient means to develop custom software. Using a question-and-answer technique, a program generator prompts the user to provide the information necessary to create a full computer program, usually in some other language (for example, BASIC, COBOL, and so on). From a software viewpoint, this is still a new microcomputer technology.

The obvious advantage of program generators is their ability to generate custom software in significantly shorter time periods than alternative methods of custom programming. However, there are potential weaknesses in this approach. Many functional capabilities of high-level software products may be difficult, if not impossible, to achieve through program generators.

Although program generators can produce computer programs in conventional languages, some may produce programs (source codes) that are not easily revised, thus causing concern over the ability to modify the generated

codes. However, the user would not typically be expected to revise the generated code itself but to modify the input of the program generator. Still, the ability to directly revise the generated code may be viewed as a means of circumventing other limitations or restrictions of a specific program generator. The overall utility of any program generator should be evaluated in light of the user's requirements.

Microcomputer System Characteristics and Limitations

A microcomputer system is generally perceived to be a relatively inexpensive, general-purpose computer. In addition to the computer processor and its main memory, a system may include a video display terminal and keyboard for user communication with the system, floppy disks and/or hard disks for storage of programs and data, and a printer for hard-copy output. Many systems also include a communications board and a modem, both of which are necessary to allow contact with other computers via telephone lines. Although different microcomputer systems may appear to have similar characteristics, don't make any assumptions regarding the interchangeability of programs or disks among systems.

The failure to realize the limitations of microcomputer technology has been a major problem confronting users. The difficulties caused by these limitations can apply to custom applications as well as prepackaged problem-solving software. If limitations are not recognized, a user might attempt to implement an application that is more properly suited for a larger computer processor with greater capabilities. Therefore, it is most important for the prospective user to consider the limitations of the microcomputer prior to implementing a specific application.

Although microcomputer limitations have been and continue to be significantly affected by technological advances, the areas for consideration remain the same. They include the following.

Processor Speed

The internal processing speed of microcomputers is quite impressive when compared to the speed of computers ten or fifteen years ago. However, microcomputers are still significantly slower than the large mainframe computers available today. Most microcomputer applications will tend to be limited by the speed of the slowest peripheral device on which they depend (that is, the printer or disk drive). The processor does have a finite capacity.

Multiuser System

Many microcomputer systems provide for concurrent use by multiple operators. Such situations increase the possibility of user contention for the processor's capacity.

Operating System

Most microcomputers are controlled by an operating system. The operating system effects the execution of desired programs, manages main storage, and files on disks. The operating system typically includes utilities, or common functions, such as copying files, deleting files, printing the contents of files, and maintaining backup facilities. Each operating system has a minimum main storage requirement, which reduces the amount of main storage available for applications.

Memory Capacity

A microcomputer's available memory, referred to as RAM (Random Access Memory), determines the amount of usable space an application program can occupy. Although microcomputers with increasing amounts of memory are being marketed, it is important to recognize that the high-level programming languages used for software development do require significant amounts of memory for generated code. In addition, a greater memory capacity can aid in reducing overall processing time by accessing peripherals, especially disks, via large memory buffers.

Printer Capacity

Almost every microcomputer application will eventually need to produce some form of hard-copy output on the printer, which is the slowest component of the system. Printers vary in the maximum number of characters printed per line, this amount can often be increased by reducing the size of printed characters (condensed format). Letter-quality printers produce high-quality printouts, which may be required for word processing applications, whereas dot-matrix printers tend to be faster and may be able to produce graphics.

In contrast to mainframe computer printers whose speed is measured in hundreds or thousands of lines per minute, the speed of microcomputer printers is typically measured in characters per second. Most microcomputer printers will print a character at a time, not a complete line at a time. To compensate for speed deficiencies, some of these printers are bidirectional (that is, they print one line from left to right and the following line from right to left), thus saving carriage return time. In addition, some microcomputer systems may contain a buffer to compensate for the fast processor speed and slow printing speed, whereas other systems may record the output on a disk, with hard copy to be printed out at a later time (spooling). Alternatively, a separate hardware attachment, between the printer and the processor, can be used to achieve spooling. In general, report output should be limited to a quantity manageable in terms of the printer's speed.

Disk Capacity

The primary magnetic storage media on microcomputers are floppy and/or hard disks. The capacity and data-transfer rate of hard disks is significantly larger and faster than that of floppy disks. Therefore, it is important to evaluate the requirements of an application to determine if a floppy disk will suffice or if the greater capacity of a hard disk is required.

If hard disk storage is available, it is also important to evaluate the storage requirements of the entire system, because when there are numerous applications, it is desirable to store complete libraries of software and data files on the hard disk. Although a hard disk with a capacity of 10 or even 20 million bytes (characters) of storage may initially appear to be more than adequate, it can be easily consumed with all the programs and data files that may be required to support many applications.

Keyboard

The user interacts with most microcomputer systems via a keyboard, which is similar to the standard typewriter keyboard. The availability of a ten-key numeric key pad may be very helpful if significant volumes of numeric data are to be entered. Another method of interacting involves the use of a device called a Mouse, which allows the user to enter commands without using the keyboard.

In many systems the keyboard may be separate and detachable from the screen (CRT unit), thus allowing more convenient placement for the user. To further aid the user, programmable function keys may be available.

Data Security

Experience indicates that microcomputer technology can achieve a satisfactory level of security. However, the ability to protect programs and data from accidental loss or unauthorized access requires specific planning. The user must be sensitive to requirements for backup copies and audit trails produced on a regular basis.

Software Package Limitations

In most microcomputer environments software packages will be acquired rather than custom developed for each application. Most software packages are marketed on an "as is" basis, with the user having little or no ability to modify them. Often they are designed for use with specific microcomputer systems. In some cases the user may be able to interface data files maintained

by a package with his own programs or another package, but frequently even this capability is not available. Therefore, the utility of any purchased software package may be limited to the capabilities of that package and the microcomputer system for which it was designed.

Economic Trade-offs

Tremendous economic benefits can be derived from microcomputer capabilities; however, it is important to weigh the economic trade-offs between a microcomputer and other alternatives. In evaluating the usefulness of an application, consider a microcomputer's aforementioned characteristics and limitations.

When an application would have the vast majority of its requirements satisfied by a microcomputer, but some requirements would require larger computer processing capabilities, there may be other alternatives. Although a goal that may be accomplished by a single program or application on a large-scale computer may require two or three such programs or applications on a microcomputer, the microcomputer may still be a cost-effective solution.

Summary

Microcomputers are a very economical and powerful resource for most business environments. With proper planning, the introduction of microcomputers to an organization can be successful and rewarding.

Microcomputer technology is evolving so rapidly that it is virtually impossible to produce a completely up-to-date document. In order to adequately address clients' requirements regarding microcomputers, the practitioner should strive to be knowledgeable in current developments and anticipated trends. Much of this information can be found in computer periodicals, which are readily obtainable from local computer stores or by subscription. (See the section on references.)

Glossary

application A program or series of programs that addresses a specific business concern (for example, accounts receivable, payroll, and so on).

array A series of items arranged in a meaningful pattern, such as data positioned in columns and rows.

binary A numbering system, based on 2s rather than 10s, that is used for the electronic representation of data. It uses only the digits 0 and 1.

bit/byte A *bit* is a single binary notation (for example, 0 or 1). A *byte* is a sequence of 8 bits used to represent a character, such as a number or letter.

buffer A storage device or portion of memory used to hold data temporarily or to compensate for differences in the the rate of data flow by receiving the data at one speed and transmitting it at a different speed.

code A computer program is written in source code (that is, a programming language such as COBOL) and is compiled in object code (machine readable language). *Code* is used as a synonym for *program* or *to program* (to code).

compiler A computer program that translates the programmer's higher-level language (source code) into machine code, which can be subsequently executed.

CRT Commonly used to mean a video display device—the screen of a microcomputer. Derived from Cathode Ray Tube.

data base A collection of data files forming a common source of information that can be accessed by a computer program.

disk A storage device that allows data to be stored and retrieved in a random or sequential manner. A *hard disk* is a rotating magnetic metal plate that resembles a phonograph record. A *floppy disk* (also called a *diskette*) is a single, soft plate of magnetic film or plastic in a paper or cardboard package. Floppy disks come in various sizes, for example, 5¼ inches or 8 inches, and have varying data storage capacities.

dot-matrix printer A printer that produces each character as a combination of dots. The conventional typewriter, by contrast, produces a character with a single impression.

format A defined arrangement of words, totals, characters, and headings that presents the data as desired.

hard copy A computer printout—a tangible representation of what has been displayed on the video screen.

hardware The computer and its peripheral equipment—the physical, or tangible, part of a computer system.

high-level language A programming language in which the programmer codes the logic for the application without considering the machine code necessary for the specific computer.

interpreter A computer program that analyzes the programmer's symbolic code and immediately executes it. *See also* compiler.

key field Within a record, a data element (field) whose contents uniquely identify this record to the exclusion of others in the file.

modem A communications device that converts data compatible with data processing equipment to a form compatible with transmission facilities and vice versa.

Mouse A hand-held device that the operator uses to instruct the computer, via interaction with the video screen, rather than using a keyboard.

multiuser system A microcomputer system that can support more than one user concurrently. Typically such systems have multiple video display terminals and keyboards, a single processor, shared memory, and shared disk space.

off-loading The process by which a function (for example, printing a report) is transferred from one medium to another.

operating system A software product that governs a computer's operation and allocation of resources, including management of files and main storage, management of peripheral devices, and execution of programs.

printout Computer output on paper from a computer's printer.

program generator A program that enables a computer to automatically create other programs based on user specifications.

RAM Random Access Memory. The portion of a computer's memory that can be accessed and reused. Application software would reside here when being executed.

record A collection of data pertaining to a particular item, such as one individual's payroll record.

ROM Read Only Memory. The portion of a computer's memory that contains permanently stored software. It cannot be erased. ROM would typically contain portions of the operating system or a language interpreter.

software A computer program in machine-readable language (object code) that can be directly executed by the computer—the intangible component of a computer system.

template A preestablished array pattern for an electronic spreadsheet package that contains all the logic necessary to perform specific operations on the user-provided data.

turnkey system A system installed by a vendor who assumes complete responsibility for system design and installation, including hardware, software, training, and documentation.

user-friendly A term describing software that enables an operator to interact with the computer in a simple manner, without acquiring extensive technical knowledge or skills. This is typically accomplished by displaying on the screen either a software-generated question to be answered by the operator or a list (menu) from which the operator may select the appropriate response.

window A predefined portion of the video display that allows the operator to view information from several sources separately, but concurrently, and to move easily from one part of a job to another. The information shown can be processed, printed, or transferred from one window to another.

References

Access, the Journal of Microcomputer Applications in Engineering and Science
Ledz Publishing Co.
P.O. Box 12847
Research Triangle Park, NC 27709

Byte, the Small Systems Journal
McGraw-Hill, Inc.
70 Main Street
Peterborough, NH 03458

Computer Industry Update
Industry Market Reports
Box 4537
Mountain View, CA 94040

ICP Mini-Small Business Systems Software Directory
9000 Keystone Crossing
P.O. Box 40946
Indianapolis, IN 46240

Micro Systems, the CP/M User's Journal
Ziff-Davis Publishing Co.
One Park Avenue
New York, NY 10016

Mini-Micro Systems
Cahners Publishing Co., Inc.
Division of Reed Holding, Inc.
221 Columbus Avenue
Boston, MA 02116

PC World
PC World Communications
555 DeHaro Street
San Francisco, CA 94107

Personal Computing
A. Hayden Publishing Co., Inc.
50 Essex Street
Rochelle Park, NJ 07662

Small Business Computers
SBC Publishing Co., Inc.
33 Watchung Plaza
Montclair, NJ 07042

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950 Lee Street
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